CHAPTER 4-4

Signaling Techniques

Means for Signaling

Most successful recoveries have resulted primarily because survivors were able to *assist* in their own recovery. Many rescue efforts failed because survivors lacked the knowledge and ability necessary to assist. When needed, this knowledge and ability could have made the difference between life or death (fig. 4-54).

What can survivors do to assist in their own recovery? First, they need to know what is being done to find them. Next, they need to know how to operate the communications equipment in the survival kit and when to put each item into use. Survivors should also be able to improvise signals to improve their chances of being sighted and to supplement the issued equipment.

It is not easy to spot one survivor, a group of survivors, or even an aircraft from the air, especially when visibility is limited. Emergency signaling equipment is designed to make a person easier to find. Emergency equipment may be used to provide rescue personnel with information about survivors' conditions, plans, position, or the availability of a rescue site where recovery vehicles might reach them (fig. 4-55).

A part of a survivor's plan of action should be to visualize how emergencies will develop, recognize them, and, at the appropriate time, let friendly forces know about the problem. The length of time before survivors are rescued often depends on the effectiveness of emergency signals and the speed with which they can be used. Signal sites should be carefully selected. These sites should enhance the signal and have natural or manufactured materials readily available for immediate use. Survivors should avoid using **pyrotechnic** signals wastefully as they may be needed to enhance rescue efforts. Signals used correctly can speed up recovery and eliminate the possibility of a long, hard survival episode. Survivors should:

Pyrotechnic: Firework or any of various similar devices used for setting off a rocket or producing an explosion.

- Know how to use their emergency signals.
- Know when to use their signal.
- Be able to use their signals on short notice.
- Use signals in a manner which will not jeopardize individual safety.

The situation on the ground governs the type of information which survivors can furnish the rescue team, and will govern the type of signaling they should use. In nontactical survival situations, there are no limitations on the ways and means survivors may use to furnish information.

The are two main ways to get attention or to communicate—visual and audible. In means you use will depend on your situation and the material you have available. Whatever the means, always have visual and audible signals ready for use.

Visual Signals

These signals are materials or equipment you use to make your presence known to rescuers.

Fire

During darkness, fire is the most effective visual means for signaling. Build three fires in a triangle (the international distress signal) or

in a straight line with about 25 meters between the fires. Build them as soon as time and the situation permit and protect them until you need them. If you are alone, maintaining three fires may be difficult. If so, maintain one signal fire.

When constructing signal fires, consider your geographic location. If in a jungle, find a natural clearing or the edge of a stream where you can build fires that the jungle **foliage** will not hide. You may even have to clear an area. If in a snow-covered area, you may have to clear the ground of snow or make a platform on which to build the fire so that melting snow will not extinguish it.

A burning tree (tree torch) is another way to attract attention. You can set pitch-bearing trees afire, even when green. You can get other types of trees to burn by placing dry wood in the lower branches and igniting it so that the flames flare up and ignite the foliage. Before the primary tree is consumed, cut and add more small green trees to the fire to produce more smoke. Always select an isolated tree so that you do not start a forest fire and endanger yourself.

Smoke

Smoke signals are most effective on clear and calm days. They have been sighted from up to 50 miles away. High winds, rain, or snow tend to disperse the smoke and lessen the chances of it being seen. Smoke signals are not dependable when used in heavily wooded areas.

The smoke produced should contrast with its background. Against snow, dark smoke is most effective. Likewise, against a dark background, white smoke is best. Smoke can be darkened by rags soaked in oil, pieces of rubber, matting, or electrical insulation, or plastic being added to the fire. Green leaves, moss, ferns, or water produce white smoke.

To increase its effectiveness, the signal fire must be prepared before the recovery vehicle enters the area. The fires used by survivors for heat and cooking may be used as signal fires as long as the necessary materials are available in the immediate surroundings.

Foliage: A cluster of leaves, branches, and flowers.

Survivors should supplement the fire to provide the desired signal (fig. 4-56).

Smoke Generators

Raised Platform Generator (fig. 4-57). The survivor should:

- Build a raised platform above wet ground and snow.
- Place highly combustible materials on the platform.
- Place smoke-producing materials over the platform and light when search aircraft is in the immediate surroundings.

Ground Smoke Generator (fig. 4-58). The survivor should:

- Build a large log cabin fire structure on the ground. This provides good ventilation and supports the green branches used for producing smoke.
- Place smoke-producing materials over the fire lay; light when a search aircraft is in the immediate surroundings.

Tree Torch Smoke Generator (fig. 4-59). To build this device, the survivor should:

- Locate a tree in a clearing to prevent a forest fire hazard.
- Add additional smoke-producing materials.
- Add igniter.
- Light when a search aircraft is in the immediate surroundings.

Fuel Smoke Generator. If survivors are with the aircraft, they can improvise a generator by burning aircraft fuels, lubricating oil, or a mixture of both. One to 2 inches of sand or fine gravel should be placed in the bottom of a container and soaked with fuel. Care should be used when lighting the fuel as an explosion may occur initially. If there is no

container available, a hole can be dug in the ground, fill with sand or gravel, pour in the fuel, and light. Care should be taken to protect the hands and face.

Smoke Grenades

If you have smoke grenades with you, use them in the same pattern as described for fires. Keep them dry so that they will work when you need them. Take care not to light the vegetation in the area when you use them.

Pyrotechnics

Care should be used when operating around flammable materials.

A device containing chemicals for producing smoke or light is known as a pyrotechnic. Hand-held flares are in this category. Survivors may be required to use a variety of flares. They must know the types of flares stored in their survival kits and/or aircraft. They should learn how to use each type of flare before they face an emergency. Flares are designed to be used during the day or night. Day flares produce a unique bright-colored smoke which stands out very clearly against most backgrounds. Night flares are extremely bright and may be seen for miles by air, ground, or naval recovery forces.

The hand-held launched flares also fall in the pyrotechnic category. They were designed to overcome the problems of terrain masking and climatic conditions. For example, a person may be faced with multilayer vegetation or atmospheric conditions known as an inversion which keeps the smoke next to the ground.

Flares must be fired at the right time to be of maximum use. Smoke flares, for example, take a second or two after activation before they produce a full volume of smoke. Therefore, the flare should be set on fire just before the time it can be seen by rescue personnel. These signals should not be used in tactical environments unless directed to do so.

Pen Flares

These flares are part of an aviator's survival vest. The device consists of a pen-shaped gun with a flare attached by a nylon cord. When fired, the pen flare sounds like a pistol shot and fires the flare about 150 meters high. It is about 3 centimeters in diameter.

To have the pen flare ready for immediate use, take it out of its wrapper, attach the flare, leave the gun uncocked, and wear it on a cord or chain around your neck. Be ready to fire it in front of search aircraft and be ready with a secondary signal.

Tracer Ammunition

You may use rifle or pistol tracer ammunition to signal search aircraft. Do not fire the ammunition in front of the aircraft.

Star Clusters

Red is the international distress color; therefore, use a red star cluster whenever possible. Any color, however, will let your rescuers know where you are. Star clusters reach a height of 200 to 215 meters, burn an average of 6 to 10 seconds, and descend at a rate of 14 meters per second.

Star Parachute Flares

These flares reach a height of 200 to 215 meters and descend at a rate of 2.1 meters per second. The M126 (red) burns about 50 seconds and the M127 (white) about 25 seconds. At night you can see these flares at 48 to 56 kilometers.

Sea Marker

If you are in a water survival situation, use sea-dye markers during daylight to indicate your location.

Of the many dyes and metallic powders tested at various times for marking the sea, the most successful is the fluorescent, water-soluble, orange powder. When released in the sea, a highly visible, light green, fluorescent

cast is produced. Sea dye markers have rapid distribution power; a packet spreads into a slick about 150 feet in diameter and lasts an hour or more in calm weather. Rough seas will stream it into a long streak, which may disperse in 20 minutes.

Under ideal weather conditions, the dye can be sighted at 5 miles with the aircraft operating at 1,000 feet. The dye has also been spotted at 7 miles away from an aircraft operating at 2,000 feet.

Sea dye markers should be used during daytime and only when there is a chance of being sighted (aircraft seen or heard in the immediate area). It is not effective in heavy fog, solid overcast and storms with high winds and waves. The release tab on the packet of dye is pulled to open for use. In calm water, the dye can be dispersed more rapidly stirring the water with paddles or hands.

If left open in the raft, the escaping powder penetrates clothing, stains hands, face, and hair, and eventually may contaminate food and water. To avoid the obvious messiness, some survivors have tied the sea marker dye to the sea anchor. Others have dipped the packet over the side, letting it drain off the side into the sea. After using the dye, it should be rewrapped to conserve the remainder of the packet. Use them only when you hear or sight an aircraft. Sea dye markers are also very effective on snow-covered ground; use them to write distress code letters.

Codes and Signals

Now that you know how to let people know where you are, you need to know how to give them more information. It is easier to form one symbol than to spell out an entire message. Therefore, learn the codes and symbols that all aircraft pilots understand.

SOS

You can use lights or flags to send an SOS—three dots, three dashes, three dots. The SOS is the internationally recognized distress signal in radio Morse code. A dot is a short, sharp pulse; a dash is a longer pulse. Keep repeating the signal. When using flags, hold flags on the left side for dashes and on the right side for dots.

Ground-to-Air Emergency Code

This code (fig. 4-60) is actually five definite, meaningful symbols. Make these symbols a minimum of 1 meter wide and 6 meters long. If you make them larger, keep the same 1:6 ration. Ensure the signal contrasts greatly with the ground it is on. Place it in an open area easily spotted from the air.

Body Signals

When an aircraft is close enough for the pilot to see you clearly, use body movements or positions (fig. 4-61) to convey a message.

Paulin Signals

The paulin is a conventional signaling device used to send specific messages to aircraft. It may be packed with some sustenance kits and multiplace liferaft accessory kits. The paulin is constructed of rubberized nylon material and is blue on one side and yellow on the other. These colors contrast against each other so when one side is folded over the other, the designs are easily distinguished (fig. 4-62). The size is 7 feet by 11 feet which is a disadvantage when folded because it makes a small signal. The paulin has numerous uses. It can be used as a camouflage cloth, sunshade, tent, or sail, or it can be used to catch drinking water. The space blanket, used as a substitute for the sleeping bag in some survival kits, can be used in the same manner as the signal paulin because it is highly reflective (silver on one side and various colors on the other side).

Pattern Signals

The construction and use of pattern signals must take many factors into account. Size, ratio, angularity, contrast, location, and

meaning are each important if the survivors' signals are to be effective. The type of signal constructed will depend on the material available to survivors. Not every survivor will have a parachute, so creativity plays an important role in the construction of the signal. Survivors should remember to judge their signals from the standpoint of aircrew members who are flying over their location searching for them.

Size. The signal should be as large as possible. To be most effective, the signal should have "lines" no less than 3 feet wide and 18 feet long (1:6) (fig. 4-63).

Ratio. Proper proportion should also be remembered. For example, if the baseline of an “L” is 18 feet long, then the vertical line of the “L” must be longer (27 feet), a 2 to 3 ratio, to keep the letter in proper proportion.

Angularity. Straight lines and square corners are not found in nature. For this reason, survivors should make all pattern signals with straight lines and square corners.

Contrast. The signal should stand out sharply against the background. The idea is to make the signal look “larger”. On snow, the fluorescent sea dye available in the liferaft accessory kit can be used to add contrast around the signal. The survivor should do everything possible to disturb the natural look of the ground. In grass and scrubland, the grass should be stamped down or turned over to allow the signal to be easily seen from the air. A burned grass pattern is also effective. When in snow, a trampled out signal is very effective. Survivors should use only one path to and from the signal to avoid disrupting the signal pattern. Avoid using orange parachute material on a green or brown background is it has a tendency to blend in. Contrast can be improved by outlining the signal with green branches and leaves, piling brush and rocks to produce shadows, or raising the panel on sticks to cast its own shadow (fig. 4-64).

Location. The signal should be located so it can be seen from all directions. Survivors should make sure the signal is located away from shadows and overhangs. A large high open area is preferable. It can serve a dual function—one for signaling and the other for rescue aircraft to land.

Meaning. If possible, the signal should tell the rescue forces something pertaining to the situation. For example: “require medical assistance,” or a coded symbol used during evasion, etc. Figure 4-60 shows the internationally accepted symbols.

Parachute Signals

Parachute material can be used effectively to construct pattern signals. A rectangular section of parachute material can be formed as shown in figure 4-65. When making a pattern signal, survivors should ensure the edges are staked down so the wind will not blow the panels away.

A parachute caught in a tree will also serve as a signal. Survivors should try to spread the material over the tree to provide the maximum amount of signal (fig. 4-66).

When open areas are not available, survivors should stretch the chute over low trees and brush or across small streams (figs. 4-67 and 4-68).

Shadow Signals

If no other means are available, survivors may have to construct mounds which will use the Sun to cast shadows. These mounds should be constructed in one of the international distress patterns. Brush, foliage, rocks, or snowblocks may be used to cast shadows. To be effective, these shadow signals must be oriented to the Sun to produce the best shadow. In areas close to the Equator, a north-south line gives a shadow at any time except noon. Areas farther north or south require the use of an east-west line or some point of the compass in between to give the best results.

Light Signals

At night you can use a flashlight or a strobe light to send an SOS to an aircraft. The strobe light flashes 60 times per minute. Some strobe

lights have infrared covers and lenses. When tested away from other manufactured lights, aircraft lights have been seen up to 85 miles. At night, a survivor should use any type of light to attract attention. A signal with a flashlight, or a light or fire in a parachute shelter, can be seen from a long distance. A flashing light (strobelight) is in most survival kits.

Signal Mirror

The signal mirror is probably the most underrated signaling device found in the survival kit. It is the most valuable daytime means of visual signaling. A mirror flash has been visible up to 100 miles under ideal conditions, but its value is significantly decreased unless it is used correctly. It also works on overcast days. Practice is the key to effective use of the signal mirror. Whether the mirror is factory manufactured or improvised, aim it so the beam of light reflected from its surface hits the overflying aircraft.

The signal mirror's effectiveness is its greatest weakness if the survivor is in enemy territory. It is just as bright to the enemy as the rescuer; use it wisely! Survivors should understand that even if the mirror flash is directly on the aircraft, that same flash may be visible to others.

In a hostile environment, the exact location of the flash is extremely important. The signal mirror should be covered when not in use. One of the easiest methods is to tie the string from the mirror around the neck and tuck the mirror in the shirt. When the mirror is removed from inside the clothing, the hand should be placed over the mirror surface to prevent accidental flashing. The covered mirror may then be raised toward the sky and the hand withdrawn. The flash can then be directed onto the free hand and the aiming indicator (sunspot) located. This minimizes the undistinguishing flashing of surrounding terrain. When putting the mirror away, the survivor should remember to cover the mirror to prevent a flash.

Aiming Manufactured Mirrors. Instructions are printed on the back of the mirror.

Survivors should:

- Reflect sunlight from the mirror onto a nearby surface—raft, hand, etc.
- Slowly bring the mirror up to eye-level and look through the sighting hole where a bright spot of light will be seen. This is the aim indicator.
- Hold mirror near the eye and slowly turn and manipulate it so the bright spot of light is on the target.
- In friendly areas, where rescue by friendly forces is anticipated, free use of the mirror is recommended. Survivors should continue to sweep the horizon even though no aircraft or ships are in sight (fig. 4-69).

Improvised Signals

Signal Mirrors. Improvised signal mirrors can be made from ration tins, parts from an aircraft, polished aluminum, glass, or the foil from rations or cigarette packs. However, the mirror must be accurately aimed if the reflection of the Sun in the mirror is to be seen by the pilot of a passing aircraft or the crew of a ship.

Aiming Improvised Mirrors. The simple way to aim an improvised mirror is to place one hand out in front of the mirror at arm's length and form a “V”, with two fingers. With the target in the “V” the mirror can be manipulated so that the majority of light reflected passes through the “V” (fig. 4-70). This method can be used with all mirrors. Another method is to use an aiming stake as shown in figure 4-71. Any object 4 to 5 feet high can serve as the point of reference.

Survivors should hold the mirror so they can sight along its upper edge. Changing their position until the top of the stick and target line up, they should adjust the angle of the mirror until the beam of reflected light hits the top of the stick. If stick and target are then kept in the sighting line, the reflection will be visible to the rescue vehicle.

Another method is to improvise a double-faced mirror (shiny on both sides). A sighting hole can be made in the center of the mirror.

When trying to attract the attention of a friendly rescue vehicle that is no more than 90 degrees from the Sun, proceed as shown in figure 4-72.

The survivor's first step will be to hold the double-faced mirror about 3 to 6 inches away from the face and sight at the rescue target through the hole in the center of the mirror. The light from the Sun shining through the hole will form a spot of light on the survivor's face. This spot will be reflected in the rear surface of the mirror. Then, aiming at the rescue vehicle through the hole, the survivor can adjust the angle of the mirror until the reflection of the spot on the face in the rear surface of the mirror lines up with, and disappears, into the sighting hole.

When the reflected spot disappears and the rescue vehicle is still visible through the hole, the survivor can be sure the reflected light from the Sun is accurately aimed. The survivor may also “shimmer” the mirror by moving it rapidly over the target. This ensures that the part of the bright flash the rescuers see matches with the position of the survivor. This (shimmering) is especially useful on a moving target.

When the angle between the target and the Sun is more than 90 degrees (when the survivor is between the rescue vehicle and the Sun) a different method may be used for aiming. The survivor should adjust the angle of the mirror until the spot made by the Sun's rays passing through the hole in the mirror lands on the hand instead of on the face. The reflection in the back of the mirror that comes off the hand may then be manipulated in the same way (fig. 4-73).

Another method used when the angle is greater than 90 degrees is to lie on the ground in a large clearing and aim the mirror using one of the methods previously discussed (fig. 4-74).

Audible Signals

Sounds carry far over water under ideal conditions; however, they are easily distorted and deadened by the wind, rain, or snow. On land, heavy foliage cuts down on the distance sound will travel. Radios, whistles, and gunshots are some of the methods you can use to signal you presence to rescuers. Shouting and whistling signals have been effective at short ranges for summoning rescue forces. Most contacts using these means were made at less than 200 yards, although a few reports claim success at ranges of up to a mile. In some documented cases, they have been heard up to 1.6 kilometers away. Manufactured whistles have more range than a human whistle made out of wood, metal, or grass. A weapon can be used to attract attention by firing shots in a series of three. Three shots fired at distinct intervals usually indicate a distress signal. The number of available rounds determine whether this is practical. Survivors have used a multitude of devices to produce sound. Some examples are; striking two poles together and striking one pole against a hollow tree or log.

Electronic Signals

Current line-of-sight electronic signaling devices fall into two categories. One is the transceiver type; the other is the personal locator beacon type. The transceiver type is equipped for transmitting tone or voice and receiving tone or voice. The personal locator beacon is equipped to transmit tone only. The ranges of the different radios vary depending on the altitude of the receiving aircraft, terrain factors, forest density, weather, battery strength, type(s) of radios and interference. Interference is a very important aspect of the use of these radios. If a personal locator beacon is transmitting, it will interfere with incoming and outgoing signals of the transceivers.

Before using survival radios, a few basic precautions should be observed. These will help in obtaining maximum performance from the radios in survival situations.

The survival radios are line-of-sight communication devices; therefore, the best transmission range will be obtained when operating in clear terrain.

Extending from the top and bottom of the radio antenna is an area referred to as the “cone of silence.” To avoid the “cone of

silence" problem, keep the radio/beacon antenna to (at a right angle to) the path of the rescue aircraft.

Since the radios have the capability of transmitting a tone (beacon) without being hand-held, they can be placed upright on a flat elevated surface allowing the operator to perform other tasks.

Never allow the radio antenna to ground itself on clothing, body, foliage or the ground. This will seriously decrease the effective range of the signals.

Conserve battery power by turning the radio off when not in use. Do not transmit or receive constantly. Use the locator beacon to supplement the radio when transmitting is done. In tactical environments, the radio should be used as stated in the premission briefing.

Survival radios are designed to operate in extreme heat or cold. The life expectancy of a battery decreases as the temperature drops below freezing and exposure to extreme heat or shorting out of the battery can cause an explosion. During cold weather, the battery should be kept warm by placing it between the layers of clothing to absorb body heat, or wrapped in some type of protective material when it is not being used.

Survival radios are designed to be waterproof. However, precautions should be taken to keep them out of water.

Presently, a satellite monitoring system has been developed to assist in locating survivors. To activate this system (SARSAT), the transmitter is "keyed" for a minimum of 30 seconds. In a nontactical situation, leave the beacon on until rescue is heard or sighted.

Aircraft Acknowledgments

Once the pilot of a fixed-wing aircraft has sighted you, he will normally indicate he has seen you by flying low, moving the plane, and flashing lights as shown in Fig. 4-75. Be ready to relay other messages to the pilot once he acknowledges that he received and understood your first message. Use a radio, if possible, to relay further messages. If no radio is available, use the codes covered in the previous paragraphs.

Aircraft Vectoring Procedures

If you can contact a friendly aircraft with a radio, guide the pilot to your location. Use the following general format to guide the pilot:

- Mayday, Mayday.
- Call sign (if any).
- Name.
- Location.
- Number of survivors.
- Available landing sites.
- Any remarks such as medical aid or other specific types of help needed immediately.

CHAPTER 4-5

Recovery Principles

Receipt of a distress call sets a highly trained and well-equipped organization into operation; however, prompt and safe recovery is by no means ensured. The success of the rescue effort depends on many factors. Such factors as the availability of rescue forces, the proximity of enemy forces, and weather conditions can affect the success of the rescue. Above all, the survivors' knowledge of what to do in the rescue effort may make the difference between success and failure (fig. 4-76).

The role of survivors in effecting their rescue changes continuously as aircraft and rescue equipment become more sophisticated. The probability of a downed aircrew member applying long-term survival training concepts under noncombat conditions continues to decrease while increasing under combat conditions.

There are several independent organizations engaged in search and rescue (SAR) operations or influencing the SAR system. The organizations may be international, federal, state, county, or local governmental, commercial, or private organizations. Survivors are responsible for being familiar with procedures used by international SAR systems in order to assist in rescue efforts. Some international organizations are.

1. International Civil Aviation Organization (ICAO)
2. Intergovernmental Maritime Consultative Organization (IMCO)
3. Automated Mutual-Assistance Vessel Rescue (AMVER) System

National Search and Rescue (SAR) Plan

The National SAR Plan is implemented the instant an aircraft is known to be down. There are three primary SAR regions. They are:

1. Inland Region
2. Maritime Region
3. Overseas Region.

The Air Force is the SAR coordinator for the Inland Region, which encompasses the continental United States. The Coast Guard is the SAR coordinator for the Maritime Region, which includes the Caribbean Area and Hawaii. The Third National Region is the Overseas Region. The Secretary of Defense designates certain Defense Department officers as Unified Commanders of specified areas where U.S. Forces are operating. Wherever such commands are established, the Unified Commander is the Regional SAR Coordinator. Overseas regions are normally served by the Joint Rescue Coordination Center, operated under the Unified Action Armed Forces. Under the terms of the National SAR Plan, the "inland" area of Alaska is considered a part of the Overseas Region.

Survivors' Responsibilities

The survivors’ responsibilities begin at the onset of the emergency, with the dispatching of an immediate radio message. The radio message should include position, course, altitude, groundspeed, and actions planned. This information is essential for initiating efficient recovery operations.

Once recovery operations have been initiated, survivors have a continuing responsibility to furnish information. Both ground and radio signals should be immediate considerations.

If a group of survivors should become separated, each group member should, when contacted by rescue forces, provide information surrounding the dispersal of the group.

The greatest responsibility of the survivor is to follow all instructions to the letter. The intelligence officer will brief aircrew members on procedures for tactical situations. These instructions must be followed clearly since it could mean the difference between life and death. When rescue personnel tell the survivor to unhook from the raft—it should be done immediately! If instructions are not followed, survivors could be responsible for causing their own death and/or the death of rescue personnel.

Methods of Recovery

Recovery Site

Consideration must be given to a recovery site. The survivor's major considerations are the type of recovery vehicle carrying out the recovery and the effects of the weather and terrain on the rescue aircraft, such as updrafts and downdrafts, heat, wind, etc. Survivors should try to pick the highest terrain possible in the immediate area for pickup. When locating this rescue site, they should watch for obstacles such as trees, cliffs, etc., which could limit the aircraft's ability to maneuver. Overhangs, cliffs, or sides of steep slopes should be avoided. Such terrain features restrict the approach and maneuverability of the rescue vehicle and require an increase in rescue time.

Even though survivors should select a recovery site, it is the final responsibility of rescue personnel to decide if the selected site is suitable.

Recovery Procedures

Knowing Current Procedures. Since procedures involving recovery vary with changes in equipment and rescue capability, survivors must always know the current procedures and techniques.

In deciding whether or not supplies should be dropped, rescue forces consider such factors as the relative locations of the distress site to rescue unit bases, the lapse expected before rescue is initiated, and the danger of exposure. If a delay is expected, supplies are usually dropped to survivors to help sustain and protect them while they await rescue. The mobility of survivors on the land generally makes it possible to recover equipment dropped some distance away, but airdrops at sea must be accurate.

Aircraft with internal aerial delivery systems, such as the HC-l30, are the most suitable for delivery of supplies to survivors. Aircraft having bomb bays or exterior racks capable of carrying droppable containers or packages of survival equipment are the next most suitable for dropping supplies. However, these aircraft are not always available for supply dropping operations, so aircraft not specifically designed for this function may have to be used.

Rescue by Helicopter. Helicopters make rescues by landing or lifting. Landings are usually required at high altitudes due to limitations of helicopter power for maintaining a hover. Hoist recovery is the preferred method for effecting a water rescue. Helicopter landings are made for all rescues when a suitable landing site is available, and danger from enemy forces is not a problem. Hovering the helicopters and hoisting the survivor aboard requires more helicopter power than landing and presents a hazard to both the aircraft and the survivor. There is a danger if helicopters are operated close to collapsed parachutes. Parachute inflation by rotor downwash can cause the parachute to be sucked into the rotor blades of the helicopter.

After landing, a crewmember will usually depart the aircraft. If for some reason this

cannot be done, as in combat, the survivor should approach the helicopter from the 3 o'clock to 9 o'clock position relative to the nose of the helicopter and follow instructions (fig. 4-77).

Rescue by Fixed-Wing Aircraft on Land. The most significant role played by fixed-wing aircraft in rescue operations is providing immediate assistance to survivors and serving as the "eyes" of approaching rescue units. This is done by pinpointing the survivors' position, orbiting the survivors, and dropping survival equipment. This type operation improves the morale of the survivors, fixes the survivors' location to prevent additional searching, and saves valuable time in getting the pickup unit on the scene.

The role of fixed-wing aircraft in actually performing a rescue is limited to instances where there is a suitable runway near the survivor or where the aircraft is designed to operate from rough and improvised strips. Fixed-wing aircraft rescues have often been made in very cold climates where the aircraft have either used frozen lakes or rivers as runways or, when fitted with skis, have operated from snow-covered surfaces and glaciers. However, landing in unknown terrain under what appears to be ideal conditions is very dangerous.

Rescue by Ship. When a distress craft or survivors are considerable distance from shore, rescue will normally be by long-range ships (specialized SAR ships, warships, or merchant ships). The rescue methods used by these ships vary considerably according to their displacement and whether the rescue is made in midocean or close to land. Weather, tides, currents, sea conditions, shallow water, reefs, daylight, or darkness may be important factors.

Although it appears obvious that a marine craft should be used for rescue operations, it may be advisable to initiate an alternate method of recovery. For example, helicopters may be used to evacuate survivors picked up by marine craft in order to speed their delivery to an emergency care center.

Removal of survivors from the water, liferafts, lifeboats, or other vessels to the safety of the rescue vessel deck may be the most difficult phase of a maritime search and rescue mission. In most cases, survivors will have to be assisted aboard. For this reason, all SAR vessels are usually equipped and prepared to lift survivors from the water without help from the survivors. There are numerous methods for rescuing survivors which may be used by SAR vessels. The most commonly used methods are listed in this chapter and are generally grouped as rescue of survivors in the water and rescue of survivors directly from their distressed vessel.

When rescuing people from water, the following methods are generally used:

- Ship alongside/swimmer.
- Ship alongside/line thrower.
- Ship alongside/ small boat.
- Ship circle/trail line.

The most commonly used methods for rescuing personnel who are aboard distressed vessels are:

- Ship to ship/direct.
- Ship to ship/raft haul.
- Ship to ship/raft drift.
- Ship to ship/small boat.
- Ship to ship/haulaway line.

Rescue by Boat. When survivors are located on lakes, sheltered waters, rivers, or coastal areas, rescue will often be made by fast boats of limited range based close to the survivors or by private boats operating in the area.

Rescue boats are usually small and may not be able to take all survivors on board at one time; therefore, a sufficient number of boats to offset the rescue should be dispatched to the distress scene. When this is not possible, each boat should deploy its rafts so that those survivors who cannot be taken aboard immediately can be towed ashore or kept afloat while they are waiting. The boat crew should make sure any survivors who must be

left behind are made as secure as circumstances permit.

Assistance to an aircraft that has crashed or ditched on the water will usually consist of transferring personnel from plane to boat and picking up survivors from the water or liferafts. It may also include towing of an aircraft which is disabled on the water.

Coordinated Helicopter/Boat Rescues. Occasionally, boats and helicopters will be dispatched for a rescue operation. Generally the first rescue unit to arrive in the area of the survivors will attempt the first rescue.

If the helicopter arrives first, the boat will take a position upwind of the helicopter in the 2 o'clock position at a safe distance and stand by as a backup during the rescue attempt.

If the helicopter must abort the rescue attempt, the pilot will depart the immediate area of the survivor and signal for the boat to move in and make its rescue attempt. Additionally, the helicopters may turn out the anticollision rotating beacon to indicate they require boat assistance or are unable to complete the rescue. In certain operations where helicopter and boat coordinated rescue can be foreseen, specific signals should be prearranged.

If the boat arrives first and makes the rescue, it will transfer the survivor to the helicopter to effect a rapid delivery to medical facilities.

Pickup Devices

Assistance. When rescue forces are in the immediate area of survivors, they will, if conditions permit, deploy pararescue personnel to assist the survivors. Unfortunately, conditions may not always permit this, so survivors should know how to use different types of pickup devices.

Common Factors. Some common factors concerning all pickup devices are:

1. The device should be allowed to ground to discharge static electricity before putting it on.
2. To ensure stability, survivors should sit or kneel when putting on a pickup device. Do not straddle the device.
3. If no audio is available, survivors should visually signal the operator of the cable when ready for liftoff—"thumbs up" or vigorously shake the cable from side to side.
4. Most devices can be used as a sling (strap).
5. Survivors must remember to follow all instructions provided by the rescue crew. When lifted to the door of the helicopter, survivors should not attempt to grab the door or assist the operator of the cable in any way. They must not try to get out of the pickup device. The hoist operator will remove the device after the survivor is well inside the aircraft.

Rescue Sling. Before putting on the rescue sling (strap), the survivor should face the drop cable and make sure the cable has touched the water or ground and lost its charge of static electricity.

The most commonly accepted method for putting on the rescue sling (strap) is the same as putting on a coat. After connecting the ring to form the sling (strap), the survivor's arms should be inserted one by one into the sling (strap) as it swings behind. The sling (strap) loop should be against the survivor's back with an arm around each side of the strap. The webbing under the metal ring can be held until tension is put on the cable. The survivor's hands may then be interlocked and rested on the chest. This tends to lock the survivor into the sling (strap) as upward pressure is applied (fig. 4-78).

Another way to enter the strap is to grasp the strap with both hands and lift it over the head to bring it down under the arms and around the body. Regardless of the method used, the survivor should remember the webbing and metal hardware of the device should be directly in front of the face.

Basket. If a basket is used, it will probably be accompanied to the water or ground by a

member of the helicopter crew. The crewmember will assist survivors into the basket. There are two types of baskets: The litter type in which the person lies flat, and the seat type that survivors enter and sit down in as they would in a chair (fig. 4-79).

Forest Penetrator. The forest penetrator rescue seat is designed to make its way through interlacing tree branches and dense jungle growth. It can also be used in open terrain or over water. The device is equipped with three seats which are spring-loaded in a folded position against the body or main shaft and must be pulled down to the locked position for use. On the main shaft of the tube, above the seats, there is a zippered fabric storage pouch for the safety (body) straps which are ready when lowered to the survivor for a land pickup. The penetrator may also be equipped with a flotation collar.

NOTE: If the forest penetrator is used for water pickup, it will be equipped with the flotation collar which enables the device to float with the upper one-third (approximately) of the device floating above the water. Additionally, for water pickups, one strap will be removed from the packaged position, and one seat will be locked in the down position to assist the survivor in using the penetrator.

The safety strap is pulled from the storage pouch and placed around the body to hold the person on the penetrator seat. The strap should not be unhooked unless there is no other way to fasten it around the body. The survivor must make certain the safety strap does not become entangled in the lifting cable. After the strap is in place, the seat should be pulled down sharply to engage the hook which holds it in the extended position. The survivor can then place the seat between the legs. Then the survivor should pull the safety strap as tight as possible ensuring the device fits snugly against the body. The survivor must always keep the arms down, elbows locked against the body, and not attempt to grab the cable or weighted snap link above the device. After making certain the body is not entangled in the cable, the signal to be lifted can be given (fig. 4-80).

In a combat area, under fire, survivors may be lifted out of the area with the cable suspended before being brought into the helicopter. It is important to be correctly and securely positioned on the pickup device. The seat should always be held tightly against the crotch to prevent injury when slack in the cable is taken up. The hands should be kept below and away from the swivel on the cable with the arms around the body of the penetrator. Survivors should keep their head close to the body of the penetrator so that tree branches or other obstructions will not come between the body and the hoist cable.

When survivors reach a position level with the helicopter door, the hoist operator will turn them so they face away from the helicopter and then pull then inside. The crewmember will disconnect the survivors from the penetrator once the device is safely inside the helicopter.

The forest penetrator is designed to lift as many as three persons. When two or three survivors are picked up, heads should be kept tucked in and each individual's safety strap drawn tight. The penetrator can be used to lower a paramedic or crewmember to assist injured personnel, and both (survivor and paramedic) can be hoisted to the helicopter. If the forest penetrator seat blades have been lowered in a tree area, and if for any reason the pickup cannot be made, the blades should be returned to the folded position to prevent possible hang-up on tree limbs or other objects while the device is being retracted.

With all types of devices, it is necessary to watch the device as it is lowered. The devices weight about 23 pounds. If the device were to hit a survivor, it could cause a serious injury or death.

Other Devices

There are other devices which could be used to pick up survivors. Some of them are the Motley and McGuire rigs, the Swiss Seat and Stabo rig, and the Rope Ladder.

Motley and McGuire Rigs (figs. 4-81 and 4-82). These devices may be carried by Army helicopters either designated as the recovery aircraft in assault or for use to insert or extract special ground forces. The device is normally packed in a weighted canvas container and dropped by rope. The device is dropped to the survivor, who is allowed time for putting it on. The helicopter then returns trailing a rope which is then fastened to the device for pickup. Generally, the survivor is not lifted into the helicopter; therefore, all safety straps should be securely fastened.

Swiss Seat and Stabo Rig (figs. 4-83 and 4-84). These devices are carried by special ground forces who may require instant extraction by helicopter. Special ground forces put their devices on and wait for the helicopter to drop ropes which are snapped into the devices for rapid extraction. Although not normally carried aboard the aircraft, the Army helicopter may supply one of these devices to the survivor. Again, the survivor would not be hoisted into the helicopter.

Rope Ladder. This device is used primarily by the Army and special ground forces. If this device is used, it should be approached from the side and not the front. The survivor should climb up a few rings, sit down on a rung, intertwine the body with rungs (fig. 4-85). The survivor should not try to climb up the ladder and into the helicopter.

Preparations for Open Seas Recovery

On sighting rescue craft approaching for pickup, (boat, ship, conventional aircraft, or helicopter), survivors must quickly clear any lines (fishing lines, desalting kit lines, etc.) or other gear which could cause entanglement during rescue. All loose items should be secured in the raft. Canopies and sails should be taken down to ensure a safer pickup. After all items are secure, the survivor should put on the helmet (if available). The life preserver should be fully inflated with the oral valve locking nut tight against the mouthpiece. Survivors should remain in the raft, unless otherwise instructed, and disengage all gear except the preservers. If possible, rescue personnel will be lowered into the water to assist survivors. The survivors should remember to follow all the instructions given by rescue personnel.

If helicopter recovery is unassisted, the survivor will be expected to do the following before to pickup:

- Secure all loose equipment in raft, assessory bag, or in pockets.
- Deploy sea anchor, stability bags, and accessory bag.
- Partially deflate raft and fill with water.
- Unsnap survival kit container from parachute harness.
- Grasp raft handhold and roll out of raft.
- Allow recovery device and (or) cable to ground out on water surface.
- Maintain handhold until recovery device is in the other hand.
- Mount recovery device (avoid raft lanyard entanglement).
- Signal hoist operator for pickup.

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